DIMENSIONS NBS

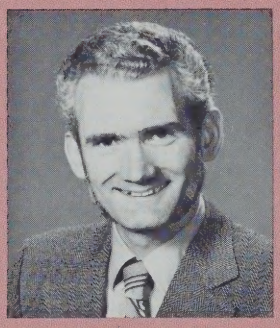
The magazine of the National Bureau of Standards U.S. Department of Commerce

December 1978

SOLAR HEATING AND COOLING.
See page 4.

COMMENT

SOLAR ENERGY RESEARCH



Over the brief span of six years, solar energy research, development, and demonstration expenditures by the Federal Government have grown from an annual level in the tens of thousands of dollars to a $500 million enterprise projected for this year. The burgeoning private sector interest in solar technologies has stimulated and benefited from this substantial Federal investment.

The National Bureau of Standards has been involved deeply with both government and private sector activities, especially in the application of the sun's energy for satisfying heating, hot water, and cooling needs in buildings. Through the Solar Technology Program in the Center for Building Technology, the Bureau has been working with other Federal agencies, standards-writing organizations, industry, designers, consumers, and others to help develop performance criteria and standards for solar heating and cooling applications. Our continuing efforts in this area provide the measurement technology needed to develop these criteria and standards and to ensure that the growing solar community is built on a firm base.

The article called "Solar Heating and Cooling: Standards for a Maturing Industry" in this issue of DIMENSIONS provides an overview of the Bureau's solar projects to date and explains why they are vital to the health of the new industry.

Despite the progress made over the past several years in refining our information about solar components and systems, and the materials used in solar equipment, much work remains. The growing attention to "passive" solar systems highlights the importance of continuing measurement-related research. Considerable research still needs to be done to define adequately criteria and measurement methods for passive systems. Some analytical methods for sizing such systems have been developed, but they have not all been validated. Acceptable techniques for predicting and measuring storage capacity and energy distribution in passive systems also need to be developed.

The attractiveness of solar energy as an alternative energy resource has made its development and application a high national energy priority. We need to take advantage of the environmental, national security, and other important benefits offered by solar heating and cooling technologies. We cannot take the chance that the national stake in solar energy might be jeopardized by a lack of performance criteria and standards. NBS research will continue to be an essential ingredient of government and private sector efforts to make sure we have those basic and very important tools.

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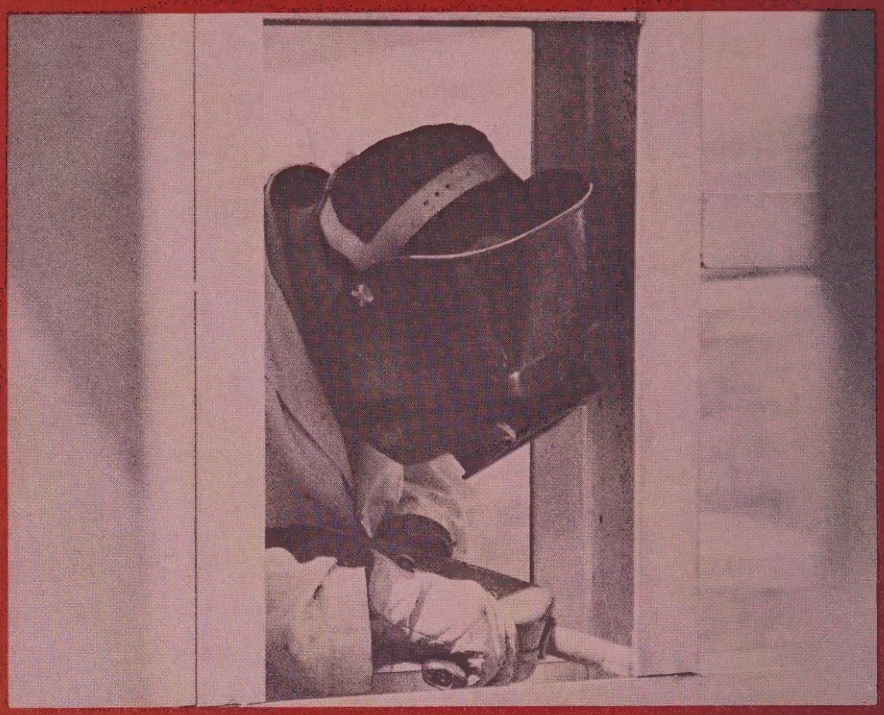

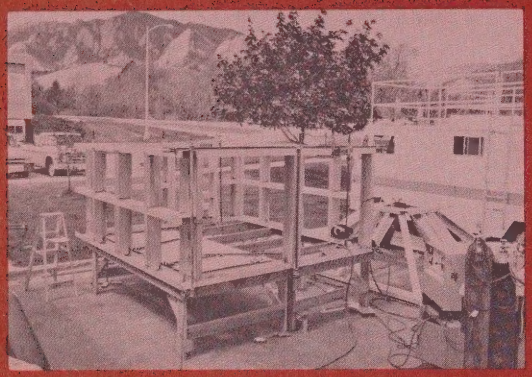

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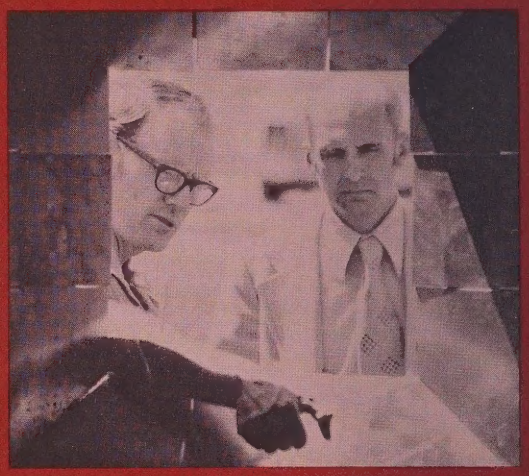

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Testing for EMI

by Frederick P. McGehan

1. A welder from the NBS Instrument Shops Division concentrates on fitting the pieces of the frame together.

2. The skeleton of the TEM cell begins to rise in a parking area to the north of the Radio Building.

3. Bell Labs personnel made several inspection trips. Pictured above are, left to right: Don Nash and Alex Busala (standing) of Bell Labs, Myron L. Crawford and John L. Workman of NBS' Electromagnetic Fields Division, and Don Heirman of Bell Labs.

4. Crawford, chief technical supervisor on the project, shows the interior of the TEM cell to Wayne Johnson of the Ford Motor Company. The automobile industry is concerned about possible electromagnetic interference problems with cars of the 1980's which will utilize microcomputers and microprocessors.

5. William A. Wilson, chief of the NBS Instrument Shops Division, and Crawford inspect the completed cell before its shipment.

6. Workman and Crawford check data being obtained from the TEM cell in a dry run before it is shipped back to New Jersey.

7. On the road—The TEM cell, with a tarpaulin cover over the top, passes across the front of the Boulder Laboratories on the first leg of its trip to Holmdel, N.J.

8. Bell Labs personnel are shown rolling the cell into position at the Holmdel, N.J. laboratory. The entry way was initially too small for the cell to fit through, so it had to be enlarged.

WHEN Bell Laboratories of Holmdel, New Jersey, wanted to develop a large enclosure to test electronic telephone equipment for electromagnetic interference (EMI), the firm came to the only place in the country that could meet its needs—the National Bureau of Standards' Electromagnetic Fields Division in Boulder, Colorado.

The Boulder laboratories several years ago developed the first such enclosure, called a transverse electromagnetic (TEM) cell, as an adjunct to research into the effects of EMI.*

The original cell (3 × 3 × 6 meters) is constructed of a skin of sheet aluminum welded on the inside to form a continuous, conductive shield. Objects in this enclosure are thus isolated from the radiation present in the outside environment. Furthermore, the cell is lined with an absorbent material that prevents high frequency electromagnetic signals produced within it from reflecting off interior surfaces. Thus, the cell can be used to determine the electromagnetic radiation produced by a device, or to test the performance of equipment in the presence of a well characterized source of electromagnetic radiation.

Since the development of the first TEM cell, NBS has consulted with other government agencies and private companies in the construction of similar but much smaller enclosures.

When Bell Labs decided to test telephone equipment both for output of electromagnetic radiation and for susceptibility to EMI, the size of the necessary TEM cell (2.8 × 2.8 × 5.6 meters) posed a technical and economic problem that could not be solved commercially. Bell officials approached NBS for aid, and the Bureau agreed to design and build the cell on a reimbursable basis with the understanding that the procedures would be documented and made available to the public. NBS is in the process of completing two technical reports aimed at those interested in constructing TEM cells.

The Bell project is depicted visually on these pages. Instrument Shops personnel at the NBS labs in Boulder began work in March 1978, and the completed TEM cell was delivered on schedule to Bell Labs in Holmdel, N. J., on September 11. □

McGehan is a public information specialist with the NBS Boulder Program Information Office.

** See "A Problem of Growing Concern: EMI," March 1978 DIMENSIONS.*

SOLAR HEATING & COOLING:

Standards for a Maturing Industry

by Mat Heyman

A bell rings briefly, disturbing the peacefulness of the quiet, sunny afternoon. Then there is a long, slow mechanical groan as an engine starts up, accompanied by a low hissing noise. Double metal doors flush with the ground quickly swing open to reveal a platform rising up from a concrete missile bunker below. Within a dozen seconds, the tests are ready to begin.

No, this is not a weapons experiment, although the scene is actually a former NIKE missile installation. But the solar energy project being carried out here, 35 kilometers northwest of Washington, D.C., does have something to do with our national welfare.

The bunker and elevated lift are located just off the main grounds of the National Bureau of Standards in Gaithersburg, MD. The site is being used by NBS researchers in a project to analyze the performance of solar collectors, key components of systems that convert the sun's rays into usable energy for hot water and heating and cooling.

The solar collectors are mounted so that they can be raised to ground level for outdoor tests. When researchers wish to work indoors with the equipment—on rainy days, for instance—the lift is lowered by the flick of a switch into an underground building.

Heyman is a writer and public information specialist in the NBS Public Information Division.

Solar Activities

The collector tests are part of a varied program of solar activities being carried out by NBS with funding from the Department of Energy and the Department of Housing and Urban Development, those agencies responsible for Federal solar energy programs. NBS is helping to lay the technical groundwork for the standards which are needed if solar heating and cooling technologies are to make the transition from the unusual to the commonplace.

Without standards to spell out minimum requirements for technical performance and safety—as well as standards to measure whether or not equipment meets those requirements—prospective solar designers, installers, and purchasers have no way to judge the capabilities and limitations of solar energy systems before they are actually in place. Without standards, manufacturers of solar equipment cannot hope to gain the high level of consumer confidence so basic to growth in the industry.

Most solar heating and cooling systems incorporate an array of materials and equipment for which some standards already exist. For new equipment and in new applications, however, additional standards are frequently called for.

There has been a flurry of activity in this area recently, and several key standards have now been developed. But many that are necessary still do not exist, except at the drawingboard stage.

COVER STORY

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Types of Standards

What types are needed? Among the most vital standards are those which set out reliable methods for testing the thermal, optical, and mechanical performance and safety of solar equipment. These standards would answer questions like, "How should a solar collector be tested in order to compare its thermal efficiency to that of other collectors on the market?" and "How can a solar energy system's safety be judged?"

Many of the components and materials used in solar energy systems will be exposed to extremes of weather, so test methods for assessing the durability and reliability of the materials are also critical at an early point.

Standards for designing and selecting the solar system, its subsystems, components, and materials are a prerequisite for a flourishing solar industry. Designers need these guidelines to help decide how many square meters of collectors will be needed to provide a building's hot water needs, for example.

Reliability may be the password which determines whether or not solar technologies make a more complete entry into the marketplace. Improper installation or servicing will jeopardize the value of a well manufactured and properly designed system. So standards for initial installation and subsequent servicing are needed.

It goes almost without saying that basic performance specifications for solar systems and each of the components are a necessity in order to ensure that minimum quality levels are met.

Once the standards are established, testing laboratories must be available to analyze whether or not individual products meet the appropriate standards. First, however, the laboratories that perform the testing will have to meet qualification requirements and should be accredited by a recognized organization. Laboratories that are accredited to perform tests will have to draw upon specific criteria for certifying solar equipment.

There are many reasons why the needed standards are not yet available. Foremost among these is the simple reality that solar technologies are still very much in the growing stage. There also has been little in the way of data to document the performance and pitfalls of solar systems. Consequently, the standards-setters at work today often must start from scratch.

Who Should Set Standards?

Beyond the fact that there has been scant documentation of solar systems' performance and few applicable standards, there are inherent difficulties in developing the solar standards and moving them into action.

For instance, should they be set by government agencies or by industry? To date, the weight of opinion among government officials, industry spokesmen, and consumer representatives has favored the development of standards by nongovernmental organizations. This point of view dominated discussions at the Second National Conference on Standards for Solar Energy Use held in September. That meeting provided a forum for an exchange of information and ideas about the progress being made and the directions to be taken.

Ron Scott, assistant director for solar heating and cooling at the Department of Energy, told attendees at the conference, "The role of the Federal Government is to assist and, where necessary, stimulate" the industry. Scott added, "We do not consider ourselves as policemen or as regulators." Industry spokesmen at the conference exhorted their colleagues in the private sector to move quickly and innovatively on solar standards so that government intervention in the process would be minimal.

Need for Coordination

The urgent need for coordination among the many interested groups could present just as much of a challenge as establishing the standards in the first place. A somewhat unusual mixture of government, university, industry, and consumer segments of the "solar society" has been working together through the American National Standards Institute (ANSI) Steering Committee on Solar Energy Standards Development to try to ensure that such coordination becomes a reality.

Twenty-three organizations are represented on the steering committee, which has been working since 1976 to identify needs and formulate specific tasks leading to the development of national consensus standards for the utilization of solar energy for heating and cooling. The steering committee has been assigning standards development projects to organizations and keeping an overview of their activities in striving for "an orderly and effective process which will avoid duplication of effort and conflicting standards."

The potential for such duplication and fragmentation is certainly very real. There are a variety of Federal agency solar "demonstration" and financial incentive programs going on now, and additional initiatives are in the works. State Govern-

ments have been taking a more active role in some of the same ways. In fact, Florida and California have programs of standards, testing, and certification already in operation. Each passing month seems to bring plans for similar programs in other States.

Division of Responsibility

Since solar technologies require so many different kinds of standards, the division of responsibility among the standards-writing groups is a difficult task. With Federal Government participation and endorsement, the American National Standards Institute's solar steering committee has taken the lead in setting the course.

According to Robert D. Dikkers, chief of the Solar Technology Program at NBS (and chairman of the ANSI solar steering committee from 1976-1977), "The level of coordination among the varied solar interests has been raised significantly through the workings of the steering committee. The group's collective decisions now serve as a guide for those involved with solar standards."

Working in conjunction with the committee, the NBS Center for Building Technology recently prepared an updated document laying out the priorities for future development and implementation of standards for solar heating and cooling applications. Formally approved by the committee, the plan charts current timetables for action and further clarifies the role of each standards-writing organization.

Making Tradeoffs

In many respects, these standards writers will be walking a tightrope. One of the most delicate balancing acts to be performed involves the tradeoff between achieving a consensus among all concerned with individual standards and the pressing need for making available a substantial number of standards in the immediate future. The groups now working on solar standards have well established procedures for review and adoption of standards, but the usual time frame for this process may be too long for government agencies that need standards for procurement and incentive programs, for instance. Unless they are thoroughly reviewed prior to being finalized, however, the solar standards

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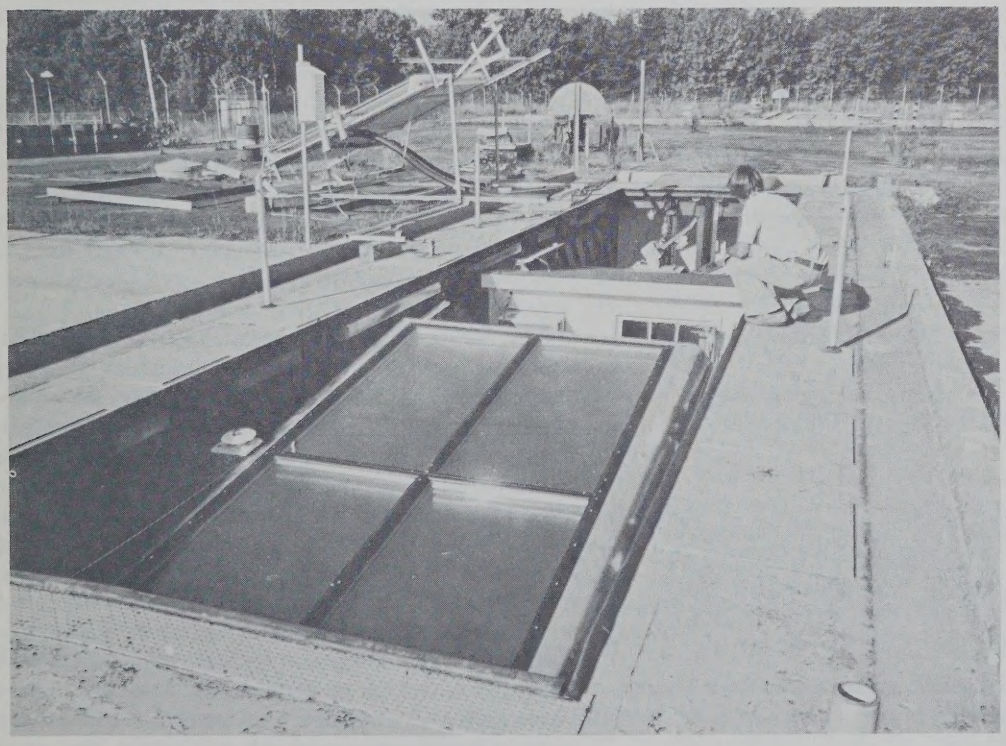
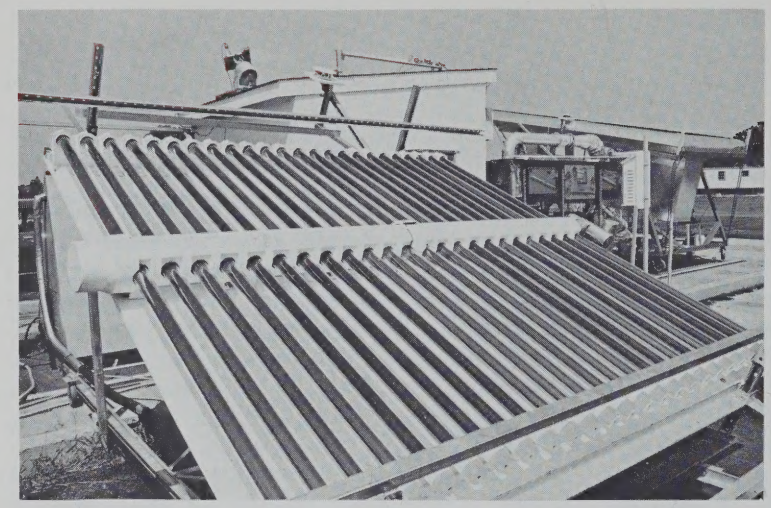


Solar collectors are mounted on a lift at a former NIKE missile emplacement as a convenience for engineers and technicians who are gathering data for a variety of NBS solar standards projects.



Right. *Performance of an evacuated tube collector is being monitored.*

Far right. *NBS Engineers Dennis Jones and John Jenkins check data indicating the thermal efficiency of solar equipment.*

may not win the confidence and backing of those who must use them.

Another area of concern is the fear that standards might stifle technological innovation in this industry. While there are solar systems now in the marketplace which will perform well, there is a substantial research and development effort being exerted by government and industry to come up with even better and more economical materials, components, and systems for converting the sun's energy. If standards are written too narrowly, they might block promising advances and squash industry competition in the solar industry. The standards must be specific enough to serve their basic purpose of providing an accurate measurement yardstick to ensure construction quality and performance levels, but circumscribed widely enough to allow room for future improvements.

The costs that solar standards might entail represent still another hurdle that the standards developers face. The ability of solar systems to compete economically with conventional energy sources is a serious concern in the industry right now, and cost reduction is a major goal. It is inevitable that certain requirements for testing, certification, and performance now being incorporated into solar standards will mean additional costs for the manufacturer that will be passed on to the consumer. These costs must be kept to a reasonable minimum.

NBS Contributions

NBS has been at the very center of the efforts by Federal agencies and nongovernmental groups to write and implement solar standards.* When Congress passed the Solar Heating and Cooling Demonstration Act in 1974—which has led the Federal Government to help pay for the installation of several thousand solar systems across the country—it authorized NBS to provide technical support to the Department of Housing and Urban Development (HUD) and the Department of Energy (DOE) (then the U.S. Energy Research and Development Administration.)

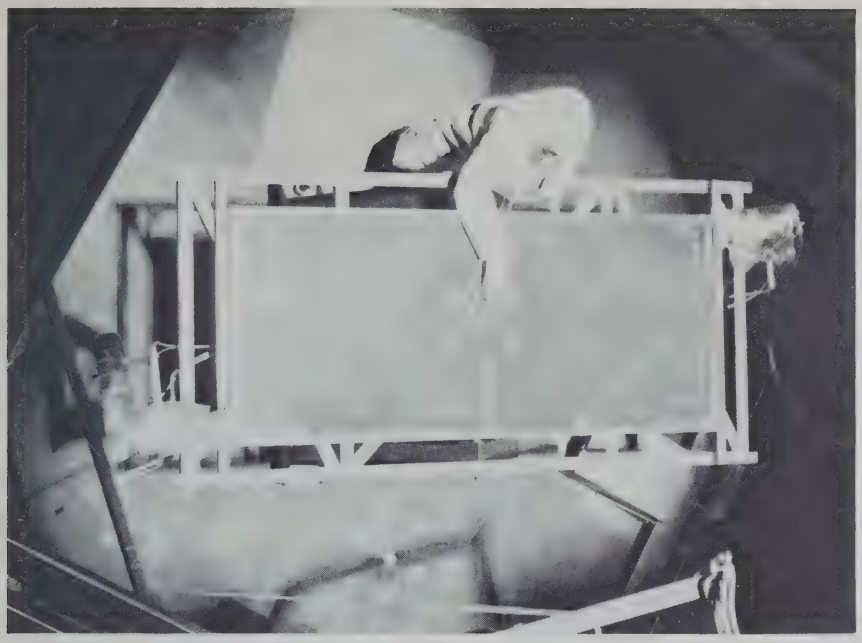
NBS developed interim performance criteria for the demonstration of solar technologies used in residences, and NBS engineers also assumed responsibility for updating the interim criteria prepared by the National Aeronautics and Space Administration that guided demonstrations in nonresidential buildings. These criteria have been used by HUD and DOE as a guide to select solar systems for installation in government-assisted demonstration buildings.

The data from the demonstration programs are only now being analyzed, and NBS will be using this information to revise the interim criteria. In fact, there already have been some revisions over the past few years. Eventually, NBS will be able to develop definitive performance criteria for use by the general public as well as in the Federal sector. These may be ready by late 1979.

In addition, Bureau researchers formulated for HUD a set of Intermediate Minimum Property Standards (MPS) for solar hot water and heating applications in residences. Written for use in the Federal Housing Administration's program which makes certain solar systems eligible for loan guarantees, the MPS have also been relied upon in the Federal Government's 10-State program offering special grants as an incentive to install solar water heaters.

NBS engineers have done the spadework on a number of solar standards adopted or under consideration by nongovernmental standards-writing groups, as well as by government agencies. Bureau researchers drafted two test methods (one for the thermal performance of solar collectors, the other for energy storage devices) that have served as a basis for American Society of Heating, Refrigerating,

* The Solar Technology Program in the Center for Building Technology draws upon an interdisciplinary team of researchers at NBS headed by Robert D. Dikkers. Dr. James E. Hill is chief of the Thermal Solar Program and Larry W. Masters is chief of the Building Materials Program.



White-garbed technician in Boeing's Solar Simulation Laboratory conducts collector tests. The work is being done under contract to NBS. This laboratory uses large xenon lamps to simulate the sun's energy.

and Air-Conditioning Engineers (ASHRAE) standards. Both standards are in wide use in a variety of Federal and State programs.

Getting Consistent Results

The usefulness and accuracy of the collector thermal performance standard have been tested and verified by NBS engineers. The Bureau has also conducted a series of round robin tests of liquid flat-plate solar collectors for DOE involving 21 laboratories across the United States. The tests were designed to determine whether laboratories in different locations would come up with consistent results using the NBS test method and the ASHRAE version. Such consistency is crucial so that manufacturers, designers, and consumers can compare the performance of collectors without having to worry that the figures will vary depending on who performed the tests, where they were conducted, and what the outdoor environment was like in those locations.

The round robin tests led NBS engineers to conclude that most of the differences in measured collector efficiency from one test site to another could be attributed to experimental error or systematic differences among the facilities rather than to differences in the outdoor environments in which the tests were run. Still, in order to minimize the effect of the outdoor environment on test results, two university researchers working with NBS developed a special analytical technique for correcting test results to "standard" environmental conditions.

ASHRAE has been developing a standard test method for evaluating the thermal performance of entire water heating systems that will represent an important advance in standards availability. (It is generally more difficult to come up with standards for complete systems rather than for individual materials, components, or subsystems.) NBS is working with ASHRAE in the development of this standard and will be conducting experiments to substantiate its validity.

Solar Information

One of the best places to start looking for information about solar hot water, heating, and cooling systems is the National Solar Heating and Cooling Information Center. Operated for the U.S. Department of Energy and the Department of Housing and Urban Development, the center offers a multitude of general and technical publications that talk about how solar systems work, give the latest on Federal financial programs, and discuss details about solar education programs (including exhibits, films, speakers, and courses). The information center also maintains a computerized file of names, addresses, and areas of expertise of builders, architects, engineers, contractors, and others who advise the center of their interest in solar energy systems.

For information from the center, write: Solar Heating, P.O. Box 1607, Rockville, MD 20850. Or call toll free at 800/523-2929; in Pennsylvania dial 800/462-4983.

Also, the Department of Energy's Technical Information Center (TIC) is an excellent source of tracking down technical information about solar energy. TIC keeps abreast of publications which report the results of federally-funded solar research as well as technical solar documents published worldwide. These are listed in "Solar Energy Update," issued monthly and available through the National Technical Information Service, Springfield Virgina 22161. This bibliography costs $27.50 annually in North America ($40 overseas) and should be ordered by NTIS #UB/C/145.

In addition, TIC maintains a machine-searchable file of ongoing solar energy research funded both by government agencies and by private industrial and research organizations. For more information about this service, write Gloria Caton, Oak Ridge National Laboratory, P.O. Box 62, Oak Ridge, TN 37830.

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Bureau researchers have also been working on a series of test methods and design and selection practices for the materials used in solar systems. The American Society for Testing and Materials (ASTM) plays the lead role in the materials standards area, and NBS has been performing research and providing draft standards for ASTM's use.

A DOE-run program to test solar collectors is drawing on a series of test procedures written by NBS. In addition to verifying the NBS test procedures, the collector testing program is aimed at gathering solid data on the performance of collectors being offered for sale today. DOE officials hope that the testing program—which is scheduled to come to a close early in 1979—will stimulate and accelerate the early establishment of a private sector-operated testing and certification program for collectors.

Implementing Standards

The matter of who will run a program to test, rate, and certify solar equipment and systems and who will accredit laboratories capable of doing the tests is still an open question. Working through NBS on a DOE-sponsored project, the ARI Foundation, Inc. (ARIF), a subsidiary of the Air-Conditioning and Refrigeration Institute, developed criteria for evaluating testing laboratories and identified those laboratories deemed qualified to test collectors according to the ASHRAE thermal performance test method. ARIF also came up with a blueprint for a certification program and has since launched such an undertaking open to manufacturers.

Through a contract with DOE, the Solar Energy Research and Education Foundation (SEREF), a sister organization of the Solar Energy Industries Association, has been developing a solar collector rating, certification, and labeling program which is designed to be combined with a laboratory accreditation program. Moreover, both Florida and California have their own programs functioning.

Laboratory Program for Solar Collectors

Meanwhile, NBS is assisting DOE and HUD in applying for a National Voluntary Laboratory Accreditation Program for solar collectors. This program—which must first be approved by the Secretary of Commerce—is viewed as a possible permanent mechanism for accrediting laboratories that test solar equipment.

It is not clear exactly when the issue of which organization will run a solar testing, rating, certification, and laboratory accreditation program will be settled. Several speakers at the recent national solar standards conference, however, stressed the need to resolve the matter quickly and efforts were being made to gain a consensus among the most involved groups.

If standards are to be used in the everyday building regulatory process, they must generally be put into a special building code format. In another effort designed to pave the way for use of the solar standards that are already written or are in progress, with DOE funding, NBS has conducted a project to determine the need for a model solar building code that could be available for incorporation into State and local building regulations. DOE has now decided to support the development of a model document on solar energy utilizing the voluntary standards system. Wide participation is being sought in preparing and reviewing this document.

Even with all of the attention now being paid to the development and use of solar heating and cooling standards, it is evident that standards alone will not ensure high quality, good performance, and dependability in solar products. Consumer representative Susannah Lawrence, who has participated in both the ANSI solar energy steering committee and the SEREF management committee, stressed that point at the recent solar energy standards conference. She told participants, "Even the best, most fair, most up-to-date standards cannot take the place of good, hard information, and there is a danger in assuming that they can. Information is a far more flexible mechanism for consumer protection than any standard could hope to be."

Nevertheless, it is recognized that standards are an essential first step for a rapidly maturing industry, especially one that has captured the Nation's imagination. Some progress toward developing a rational set of solar standards and putting it into action has been made in the past several years. Judging from the plans outlined by government agencies and private sector standards groups, even greater interest and accelerated activity in solar standards are in store. □

Solar Publications from the National Bureau of Standards

The following are just some of the publications from NBS relating to solar energy utilization. They may be obtained by writing to either of the following, as indicated in the publication identification:

Superintendent of Documents
U.S. Government Printing Office (GPO)
Washington, D.C. 20402

National Technical Information Service (NTIS)
Springfield, VA 22161

1. **"Plan for the Development and Implementation of Standards for Solar Heating and Cooling Applications,"** Revised, NBS Report NBSIR 78-1143A, June 1978. Available from NTIS, Order No. PB 283 237, price $5.25.
2. **"Interim Performance Criteria for Solar Heating and Cooling Systems in Residential Buildings,"** Second Edition, NBS Report NBSIR 78-1562, October 1978. Order through NBS Solar Technology Program Office.
3. **"Interim Performance Criteria for Solar Heating and Cooling Systems in Commercial Buildings,"** prepared for ERDA by NBS, NBS Report NBSIR 76-1187, November 1976. Available from NTIS, Order No. PB 262 114, price $5.50.
4. **"Intermediate Minimum Property Standards Supplement—Solar Heating and Domestic Hot Water Systems,"** 1977 Edition, prepared for HUD by NBS. Available from GPO, order by Stock No. 023-000-90161-7, price $12.00.
5. **"Results and Analysis of a Round Robin Test Program for Liquid-Heating Flat Plate Solar Collectors,"** NBS Technical Note 975, August 1978. Available from GPO, order by Stock No. 003-003-01959-3, price $3.00.
6. **"Environmental and Safety Considerations for Solar Heating and Cooling Applications,"** NBS Report NBSIR 78-1532, September 1978. Available from NTIS, Order No. PB 287 772, price $4.50.
7. **"Solar Energy Systems—Survey of Materials Performance,"** NBS Report NBSIR 77-1314, October 1977. Available from NTIS, Order No. PB 273 305, price $6.50.
8. **"Solar Heating and Cooling in Buildings: Methods of Economic Evaluation,"** NBS Report NBSIR 75-712, July 1975. Available from NTIS, Order No. COM 75-11070, price $4.00.
9. **"Provisional Flat Plate Solar Collector Testing Procedures: First Revision,"** NBS Report NBSIR 78-1305A, June 1978. Available from NTIS, Order No. PB 283 721, price $5.25.
10. **"Solar Energy System—Standards for Rubber Seals,"** NBS Report NBSIR 77-1437, March 1978. Available from NTIS, Order No. PB 280 114, price $5.25.

For a more complete list of NBS solar publications, write: Solar Technology Program, National Bureau of Standards, Washington, D.C. 20234.

This country's official standards of weights and measures, maintained since 1901 by the National Bureau of Standards, are linked to those maintained by the International Bureau of Weights and Measures in Sèvres, France. In fact, this international connection predates NBS. It was in 1875 that the U.S. Government signed the Treaty of the Meter, thus becoming one of the charter members of the treaty organizations that develop, maintain, and update primary physical standards for the units of measurement legally recognized by all member nations. Those nations now number 45 and include all technologically advanced countries of the world.

The organizations established under the Treaty of the Meter comprise the General Conference on Weights and Measures, the body that makes final decisions on matters related both to the International System of Units (SI) and to the international physical standards by which those units are maintained; the International Committee for Weights and Measures, the technical and administrative arm of the General Conference; and the International Bureau of Weights and Measures (abbreviated BIPM for the French version of the name).

BIPM is the primary technical facility for cooperative international research and the meeting place for all treaty organizations. Dr. Pierre Giacomo, current director of BIPM, has written a report of the recent meetings of the International Committee for Weights and Measures and its consultative committees and a brief description of all recommendations which will be considered for adoption by the next General Conference, scheduled for October 1979. Dr. Giacomo has given DIMENSIONS/NBS permission to publish excerpts from his text. The following excerpts were selected and lightly edited by Louis Barbrow, former long-time member of the NBS technical staff and currently a consultant to the Bureau on matters concerning the International System of Units (SI).

NEWS FROM THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES

THE International Committee for Weights and Measures (CIPM) held its annual meeting at Sèvres on September 19 to 22, 1978, under the chairmanship of its president, J. V. Dunworth of Great Britain. Dr. Ernest Ambler, director of NBS, attended the meeting.* One of the main tasks of this meeting was to prepare for the 16th General Conference on Weights and Measures (CGPM) which will take place in Paris in October 1979.

Three of the draft resolutions adopted by the CIPM for presentation at the General Conference are currently of great interest and are concerned with the following:

- *New definition of the candela:* The luminous intensity of a monochromatic source at 540.0154×10^{12} hertz, the radiant intensity of which is 1/683 watt per steradian.
- *New name for the unit of dose equivalent, the sievert:* The name sievert (symbol Sv) for the unit of dose equivalent or of dose equivalent index for use in radioprotection.
- *Symbols l and L for the liter:* Acceptance of the two symbols l (lowercase) and L (capital) as alternative symbols for the liter.

CONSULTATIVE COMMITTEE FOR TEMPERATURE (CCT), 12th SESSION

The CCT met at Sèvres on May 9-10, 1978, chaired by H. Preston-Thomas.

It approved the "Provisional Temperature Scale 1976 between 0.5 K and 30 K" (EPT-76). The main features of this scale had been submitted in advance for the approval of the CIPM (1976) which authorized the CCT to promulgate the final text of EPT-76. The full text of the scale has now been published by the BIPM and copies were made available at the 15th International Conference on Low Temperature Physics held at Grenoble in 1978. The French text is also to be published in *Journal de Physique* late this year and the English text in *Metrologia* in January 1979. The EPT-76 is a scale based upon a modified magnetic scale, with assigned temperatures for a

** Many members of the NBS staff serve on consultative committees and working groups of the CIPM. Reports on technical activities are published in DIMENSIONS.*

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number of fixed points in the range 0.5 K to 30 K, together with tables of differences between EPT-76 and the various already existing scales (^{4}He 1958, ^{3}He 1962, IPTS-68) and some widely used national scales.* A detailed paper on "The Derivation and Development of the 1976 Provisional 0.5 K to 30 K Temperature Scale" will be published in *Metrologia* by Working Group 4 of the CCT, which established the EPT-76.

CONSULTATIVE COMMITTEE FOR UNITS (CCU), 6th SESSION

The CCU met at Sèvres on May 17 to 19, 1978, chaired by J. de Boer.

In discussing the 4th edition due to appear about 1980 of the BIPM booklet "Le Systeme International d'Unites (SI)" (translated into English as NBS Special Publication 330), the CCU made the following decisions:

- *Names of quantities.* It was agreed to follow as a general rule the recommendations of ISO/Technical Committee 12 for the names of quantities.
- *Units in use temporarily with the SI (Table 10).* The following to be added:

"In view of the strength of existing practice in certain countries and in special fields, the CIPM (1978) considered it appropriate to continue to use the units listed in table 10, until the CIPM finds that their use is no longer needed. However, these units shall not be introduced where they have not been used up to now."

- *The barn and the bar.* It was agreed that the barn and the bar should both be kept in table 10; the standard atmosphere, sometimes used as a unit, will be transferred to table 12 (units generally deprecated). The expression "standard atmosphere" will continue to be accepted for the standard pressure 101 325 Pa.

The CCU recalled that the unit is not intended to be used to specify the quantity being measured; the quantity should always be identified separately.

The proposals for a new definition of the base unit for photometry made by the Consultative Committee for Photometry and Radiometry (CCPR) in 1977 had been submitted to the CCU. A definite preference was expressed in favor of a new definition of the candela based upon its radiant equivalent.

The CCU also approved recommendation P 1 (1977) of the CCPR suggesting that the watt be used as the unit for all those quantities characterizing the biological effects of electromagnetic radiation which can be considered as a weighted mean over the spectral distribution of power.

The International Commission on Radiation Units and Measurements had urged the CCU to admit a new special name for the unit of dose equivalent, a quantity of great importance in radioprotection. This point gave rise to much discussion, since the CCU is firmly opposed to any extension of the list of special names for SI units. Nevertheless, the CCU finally adopted the following recommendation which has been endorsed by the CIPM (1978) and will be forwarded as a draft resolution to the CGPM (1979).

Recommendation U 1 (1978)

The Consultative Committee for Units, *considering* the efforts made to introduce SI units in the ionizing radiation field and the risks which would result from confusion of dose equivalent with absorbed dose, which could lead to human beings being overexposed to irradiations, and also considering that the proliferation of special names is a real danger for the SI and must be avoided as much as possible, but that this rule can be transgressed when health hazards are involved, *recommends* that the special name sievert (symbol Sv) equal to one joule per kilogram, be given to the SI unit of dose equivalent or of dose equivalent index in the radioprotection field.

To make clear that the special names becquerel, gray, and eventually sievert are admitted for reasons of human safety, it was decided to mention them, in the SI booklet, in a separate table.

The CCU also had before it a number of other proposals for special names for units of some of the derived quantities (table 3) or names of non-SI units which some people urge should be admitted for use with SI (table 8) or should be accepted temporarily (table 10). The CCU took this opportunity to state that: a) to be included in table 3 or table 8, a unit must be recognized as useful in many fields and b) except for a few cases which could

** See the report by Dr. James F. Schooley of NBS, called "Toward a New Scale of Temperature," on page 21 of the September 1978 issue of DIMENSIONS.*

"It was in 1875 that the U.S. Government signed the Treaty of the Meter, thus becoming one of the charter members of the treaty organizations. . . ."

have been overlooked, there will be no addition to table 10; on the contrary, units will disappear from table 10 when their use in the special fields for which they were kept has diminished sufficiently for them to be no longer required.

CONSULTATIVE COMMITTEE FOR ELECTRICITY (CCE), 15th SESSION

The CCE met in Sèvres on September 13-14, 1978, chaired by F. J. Lehany.

The most recent information regarding the realization of the electrical SI units indicates that there is some evidence of definite improvement in the precision of individual experiments, but still poor agreement between different ways of realizing these units. This includes, for instance, the indirect determinations of the ampere using fundamental physical constants. As a consequence, the CCE proposed the following recommendation to CIPM (1978) which will be forwarded as a draft resolution to CGPM (1979).

Recommendation E 1 (1978)

The Consultative Committee for Electricity, *considering* the importance for all the applications of electrical measurements of a more accurate realization of the SI units, mainly of the volt and the ampere, the recent progress made in this realization, either by direct methods or by indirect ones using the determination of fundamental physical constants, the discrepancies which still exist between the results obtained by these various methods, the need of being able to compare independent realizations to throw some light on the observed discrepancies, the improvement in accuracy which will emerge as soon as a better coherence will allow us to ascertain the accuracy of the various realizations of the units, *confirms its Recommendation E 3 (1975)* to pursue and intensify research on direct realizations of the electrical units as well as on indirect realizations involving determinations of fundamental physical constants.

RESULTS OF QUESTIONNAIRES ON LENGTH CIRCULATED BY THE BIPM

The last meeting of the Consultative Committee for the Definition of the Meter (CCDM) in 1973 left open the question of a possible future change in the definition of the meter. In order to sound present opinion, the BIPM circulated to members of the CCDM in October 1977 a questionnaire on this matter. It also included questions on the reproducibility of stabilized lasers, as established by comparisons between laboratories, wavelength determinations, new stabilized lasers and new stabilization methods. A further questionnaire relating specifically to the need for a new definition of the meter was circulated in March 1978. From the answers, it appears that there is no urgent need for a change. However, most members agree that a change will be welcome in due course and that an early meeting of the CCDM will be necessary to prepare it. Consequently, the CIPM (1978) called for a meeting of the CCDM in 1979. A report on the answers to the questionnaire has been prepared by the BIPM; it will appear as an annex to the proceedings of CIPM (1978) and CCDM (1979).

WORKING GROUPS ON MASS

As a consequence of the meeting of the Working Group on Mass held at Sèvres in 1976, three small working groups have been established. Their respective scopes are: 1) formula for the calculation of air density, 2) direct measurements of air buoyancy, 3) long term stability of mass standards.

Working Group 1 is preparing a report giving detailed guidelines and tables for the calculation of air density starting from usual data such as pressure, temperature, etc. It is hoped that this report, if it is approved by the CIPM, will become a conventional guide to insure uniform evaluations of air buoyancy corrections in weighings.

Working Group 2 has begun an investigation on present and past work aimed at accurate measurements of air buoyancy (target: 1×10^{-5}). Any information on the matter may be sent to the BIPM for transmission to the Working Group.

Working Group 3 has sent a questionnaire to national laboratories, to gather information on the present state of affairs with respect to keeping, handling, and cleaning first order mass standards, and asking for information on work in progress on these matters. □

Particle-Sizing Device, page 16
Coal Gasification Materials, page 17

PARTICLE-SIZING DEVICE FOR RESEARCH AND CALIBRATION

A technique developed at the National Bureau of Standards can accurately determine the size of particles which are a few thousandths of a millimeter in diameter. The method has potential application in several areas of research. It could also be used commercially in testing laboratories as an absolute standard for calibrating particle-sizing systems and aerosol particle generators now on the market. Its use in instrument calibration could define the accuracy in certain air quality, industrial safety, and industrial process measurements, thus removing some of the ambiguity in safety assessment and quality control.
Development at NBS was carried out in part with funds from the Environmental Protection Agency. Laboratories in the Department of Defense and the Department of Agriculture interested in applying the device to their areas of research have participated in some of the testing or expressed interest in doing so.

Ilan Chabay, David S. Bright, and Robert A. Fletcher, Gas Particle Science Division, A121 Chemistry Building, 301/921-2862.

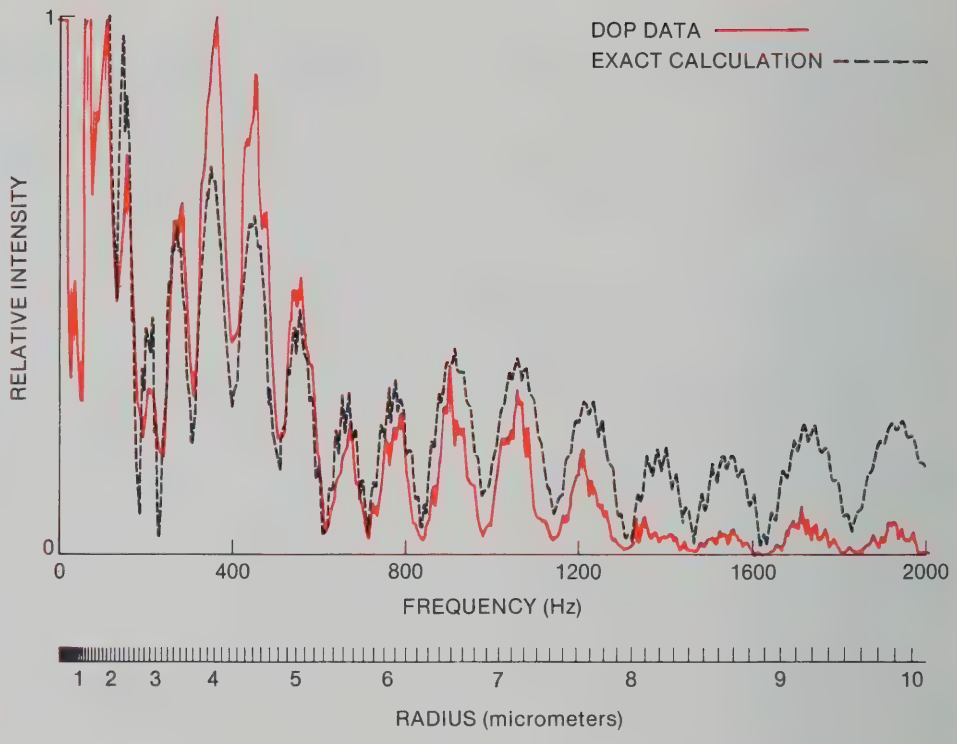


Figure 1—*Plot of relative light scattering intensity as a function of Doppler shift frequency and particle radius. The solid line is the experimentally determined curve for oil aerosol. The dashed line shows the fit to exact theoretical calculation. Only the positions of the extrema of the curves, not the heights, determine the accuracy of the measurement.*

We have developed a particle Doppler shift spectrometer (PDSS) that offers an accurate and precise way of measuring spherical particle size and size distributions in the diameter range of two to twenty micrometers. This instrument is a unique means of calibrating particle-sizing systems and aerosol generators in the laboratory without using secondary standards. It is calibrated against first principles, using an exact theory, namely solution of Maxwell's equations for spherical particles. (See Figure 1.) Particle diameters can be determined by the PDSS to within 0.2 micrometer absolute error with a precision of 0.1 micrometer.

As gravitationally settling particles pass through the incident laser beam (Figure 2), they scatter light. The particle size is measured in the PDSS by determining the Doppler frequency shift of the scattered light.

The Doppler frequency shift is dependent on the particle settling velocity, which in turn is dependent on the square of the radius. The Doppler shift spectrum characteristic of the aerosol is displayed as frequency shift versus scattered light intensity. A histogram of the light intensity peaks versus frequency gives a measurement of size distribution.

One of the several applications of the PDSS is instrument calibration. Recently, we calibrated a commercial optical particle counter (OPC) in cooperation with George Mulholland of the Fire Research Division at NBS. The calibration was necessary because there is a lack of standardized dispersable test particles in the size range of concern—three to ten micrometers. The particles used for our tests were oil droplets made by a commercially available aerosol generator. The oil aerosol was sampled simultaneously by the OPC and PDSS.

The mean diameter of the PDSS size histogram and the mean voltage of the OPC signal histogram were used to determine the OPC signal-size relationship. A summary of the results may be found in Figure 3. Figure 3 is a plot of particle diameter experimentally determined by the PDSS versus the apparent diameter indicated by the OPC. The OPC diameter is determined from the OPC data and the manufacturer's calibration literature.

Besides calibrating field and laboratory aerosol size measuring instruments, we plan to use the PDSS for characterizing aerosol generators and sources. We hope to direct future research efforts to developing new aerosol standards and measurement techniques, and to studying the light scattering and aerodynamic properties of non-spherical aerosol particulates.

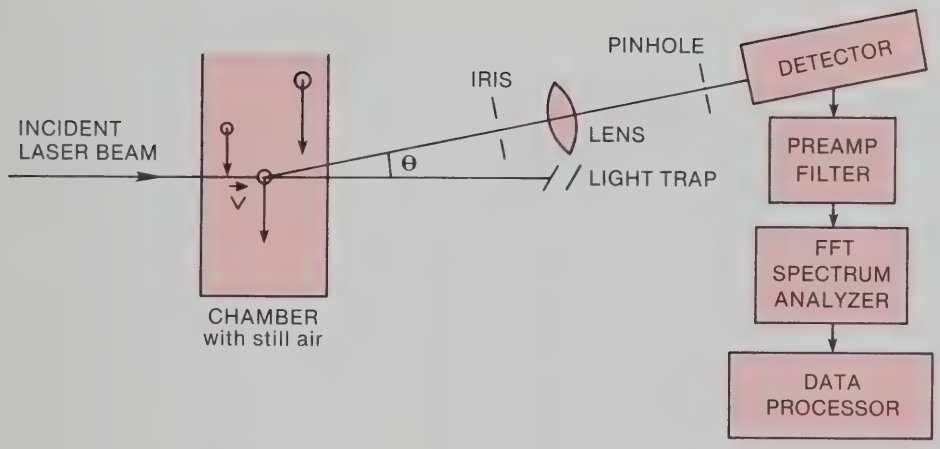
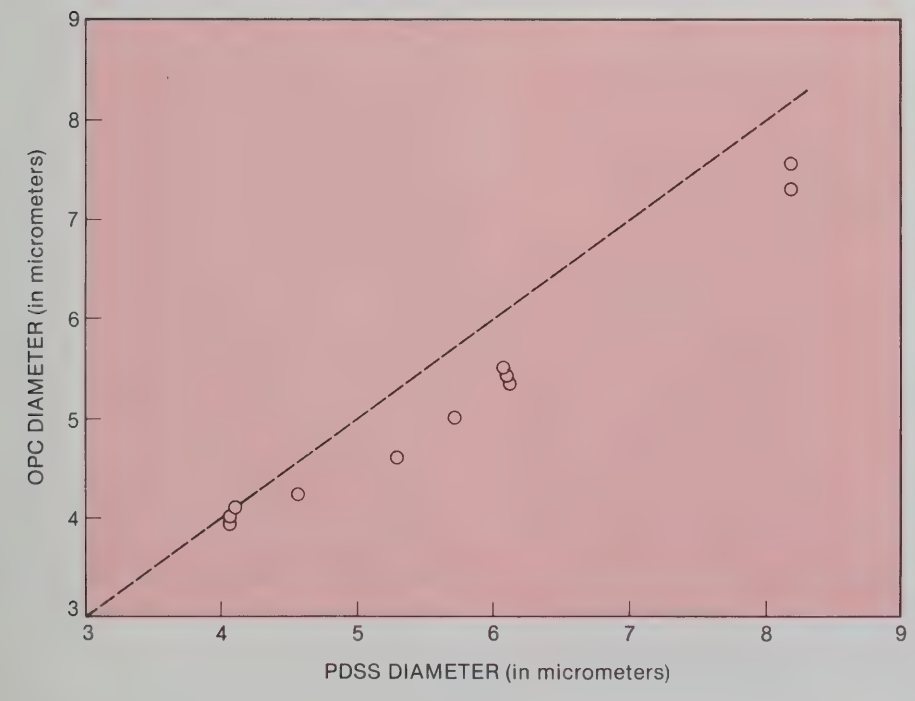


Figure 2—*Schematic diagram of the PDSS. Particles fall in still air inside a chamber which is centered on the intersection of the laser beam and the line of sight of the detector. The light scattered from the particles at angle θ is Doppler shifted from the incident laser frequency by an amount proportional to v sin θ, where v is the settling velocity of the particle. The small Doppler shift is measured by detecting the interference between the frequency-shifted light scattered from the particles and the unshifted light scattered from the chamber windows.*

Figure 3—*A plot of particle diameter experimentally measured by the PDSS versus the corresponding OPC diameter determined by the manufacturer's calibration curve. The dashed line is a hypothetical one-to-one correspondence of PDSS diameter to OPC diameter.*



CORROSION TEST METHODS FOR COAL GASIFICATION MATERIALS

Researchers at the National Bureau of Standards are involved in a project to develop reliable test methods for determining the susceptibility to stress corrosion cracking (SCC) of alloys in the elevated temperature and pressure environments existing in coal gasification systems. With these test methods, alloys proposed for new coal gasifier systems can be evaluated with regard to their ability to resist SCC. This work is sponsored by the Department of Energy.

Samuel Schneider, John H. Smith, Gil Ugiansky, and Christian Johnson, Center for Materials Science, B308 Materials Building, 301/921-2894.

Work at NBS on developing methods to test the susceptibility of materials to stress corrosion cracking (SCC) is organized into two subtasks. Subtask (a) is concerned with an evaluation of the slow strain rate test method to test alloys for temperatures up to 650 °C in simulated coal gasifier environments. Subtask (b) is concerned with the development and evaluation of a precracked, fracture mechanics test method that will be used for both laboratory and *in situ* evaluation of crack propagation for alloys in coal gasifier environments.

Subtask a: *Slow Strain-Rate Test*

The slow strain-rate test has been shown to be a viable technique for SCC testing of alloys in gaseous environments. The test was used to examine alloys and environments relevant to coal gasification systems. Austenitic stainless steels, types 310, 310S, 347, and ferritic stainless steel, type 446, were tested along with Incoloy 800 and Inconel 671.

The test gases used consisted of He, Ar, H_2S plus steam, H_2S saturated at 23 °C with H_2O vapor, and gaseous mixtures of CO, CO_2, H_2, CH_4, H_2S, and H_2O. The He

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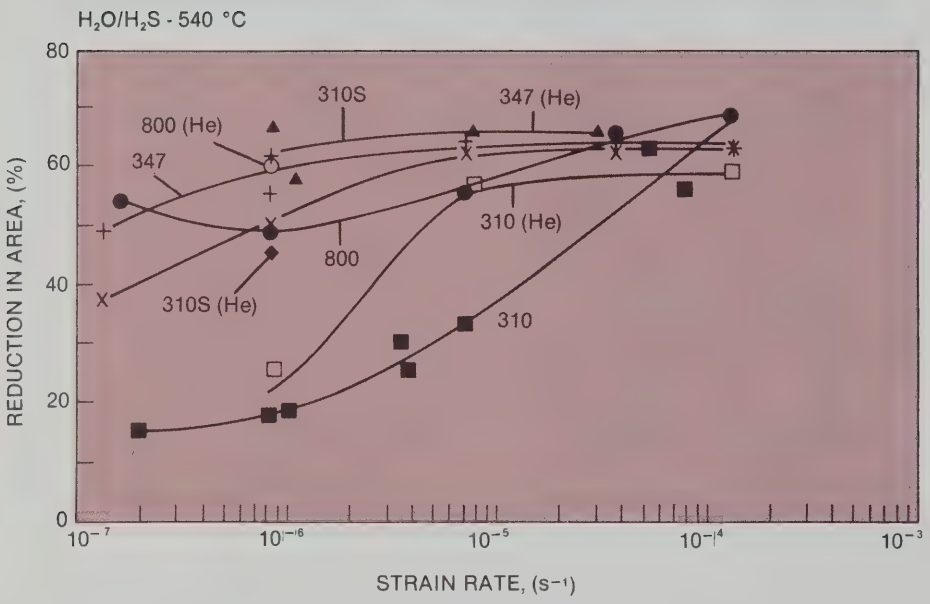
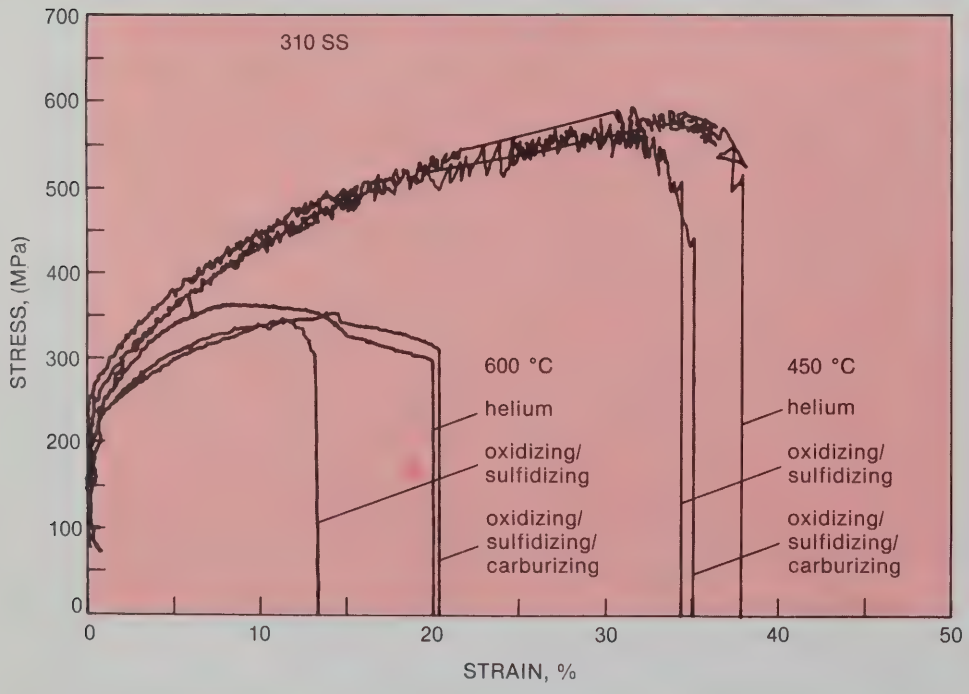


Figure 1

Figure 2



and Ar environments which were used as "normalizing" environments were compared to results for specimens tested in the other environments. The H_2S plus steam and H_2S saturated at 23 °C with H_2O vapor were used as initial, simplified coal gasification-type environments because of the high probability of SCC in those environments. (Austenitic stainless steels in sulfidic environments found in oil refineries and known to be susceptible to SCC.) The gaseous mixtures of CO, CO_2, H_2, CH_4, H_2S, and H_2O were used to simulate possible coal gasification environments.

Coal gasification candidate materials of stainless steel (SS) Types 310, 310S, and 347 and nickel alloy 800 were initially tested at 540 °C, over a range of strain rates from 10^{-4} to 10^{-7}/s, in an environment of He and in corrosive environments of H_2S plus steam and H_2S saturated at 23 °C with H_2O vapor. The results of the tests of these alloys in He and in gaseous H_2O/H_2S can be seen in Figure 1. Types 310S SS, 347 SS, and nickel alloy 800 failed with relatively high ductility in both the He and the gaseous H_2O/H_2S. However, the Type 310 SS was found to fail prematurely by intergranular cracking with low elongation and little reduction in area when tested in either environment. Numerous secondary cracks were also observed along the reduced area of the specimen. This brittle (in appearance) type fracture of 310 SS was found to be related to strain rate-induced sensitization of the grain boundaries. The test temperature of 540 °C is well within the range of temperature (450 to 870 °C) in which sensitization of 310 SS is known to occur.

The coal gasification candidate materials Types 310, 310S, 347, and 446 stainless steels, and nickel alloys 800 and 671 were tested in simulated coal gasification environments at temperatures of 450 °C and 600 °C at a strain rate of 10^{-6}/s; they

were also tested in an environment of ultra-pure He at the same temperatures and strain rate. The resulting stress-strain curves for 310 SS are shown in Figure 2. Of these six alloys, four (Type 310 SS, Type 310S SS, and nickel alloys 800 and 671) were seen to be susceptible to intergranular cracking. Two of the alloys (Type 310 SS and nickel alloy 671) failed with relatively low ductility compared to the other two alloys (Type 310S SS and nickel alloy 800) when tested at 600 °C. These failures were possibly due to different mechanisms; however, all were detected by the slow strain rate technique.

Subtask b: *Precracked Stress-Corrosion Test*

A test method based on fracture mechanics was developed to accurately characterize materials subjected to elevated temperature stress-corrosion cracking. A tension-loaded, double cantilever-beam specimen was developed for use at elevated temperature. This specimen is a modification of the wedge-loaded double cantilever beam specimen which is extensively used for stress-corrosion testing at ambient temperature. The susceptibility to stress-corrosion cracking is expressed in terms of the stress intensity factor, K_I. The crack growth rate, da/dt, due to stress-corrosion cracking is proportional to the stress-intensity, K_I, and the minimum stress-intensity value below which crack propagation is not observed is designated as K_{ISCC}. Both the commonly used wedge-loaded double cantilever beam specimen and the newly designed tension-loaded double cantilever beam specimen have the advantage, for stress-corrosion testing, that the applied stress-intensity, K_I, decreases, as crack growth occurs so that in principal, the minimum stress-intensity value below which crack growth will occur, that is K_{ISCC}, can be determined with a single test specimen.

For a fixed displacement loaded double cantilever beam specimen, the stress intensity at the crack tip is given as:

$$(1)\quad K_I = \frac{EV}{H}\left[\frac{3.46 + 2.38\left(\frac{H}{a}\right)}{7.97\left(\frac{a}{H}\right)2 + 16.48\left(\frac{a}{H}\right) + 11.32}\right]$$

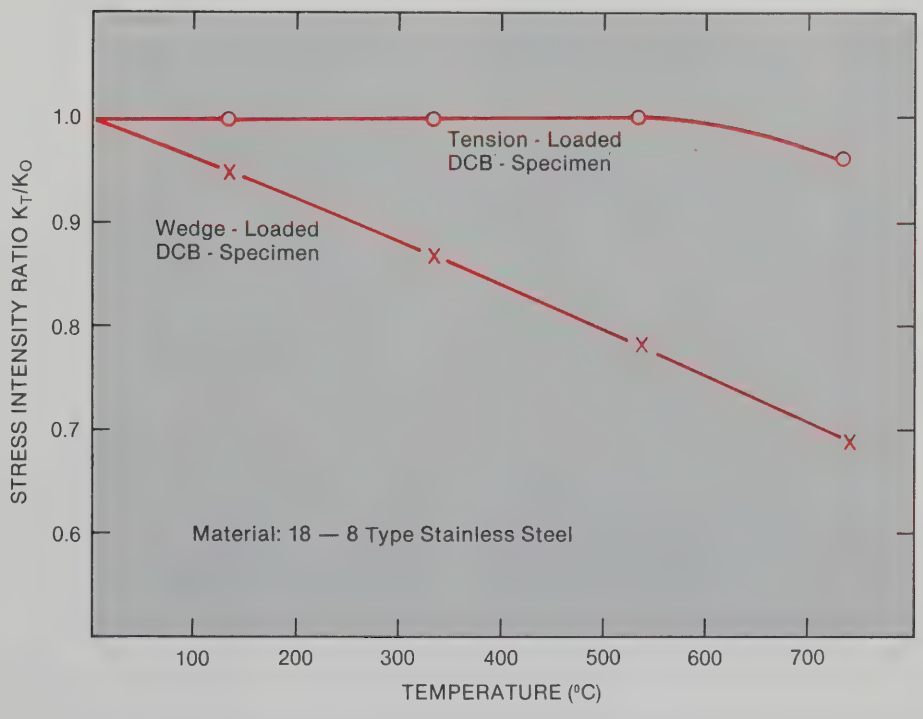
where:

E = elastic modulus of the specimen
V = displacement of specimen arms
a = crack length
B = specimen thickness
H = specimen height

Equation (1) is used as the basis for designing a double cantilever beam specimen that can be loaded to a specified K_I level at room temperature and used for testing at elevated temperature without a substantial change in the initial applied stress intensity level, K_I, due to the change in temperature. Once crack growth starts due to stress corrosion cracking at the elevated temperature, the stress intensity decreases with crack growth until the K_{ISCC} level is reached.

To demonstrate that the tension loaded double cantilever beam specimen can be made thermally compensating, a loading fixture made of 18-8 type stainless steel with a specimen of 310 stainless steel and adjustable grips made of Monel was designed and analyzed. Figure 3 shows a plot of K_T/K_O versus temperature up to 730 °C for this specimen configuration. This shows that no decrease in K_T with temperature is expected up to approximately 550 °C (1000 °F) and that up to 730 °C the decrease in K_I is only about 4 percent from the original "as-loaded" K level. By contrast, a wedge loaded double cantilever beam specimen cannot be made temperature compensating and the K_T level at 730 °C would decrease to approximately 70 percent of the "as-loaded," room temperature value, as shown in Figure 3.

Figure 3



CONFERENCES

For general information on NBS conferences, contact JoAnn Lorden, NBS Public Information Division, Washington, D.C. 20234, 301/921-2721.

CONFERENCE ON NEUTRON RADIATION PLANNED

The National Bureau of Standards and the Bureau of Radiological Health (BRH), in cooperation with the American Association of Physicists in Medicine (AAPM), will sponsor a special conference on Neutrons from Electron Medical Accelerators on April 9 and 10, 1979. The conference will be held at the NBS complex in Gaithersburg, Maryland.

Medical accelerators such as betatrons, microtrons, and electron linear accelerators (LINACS) are primarily used to produce high energy x rays for radiation therapy. When these machines are operated at energies above about 10 MeV (megaelectron volts), however, they can also produce neutrons by photonuclear interaction when the electron beam collides with machine components such as collimators and beam flatteners.

This neutron radiation represents a contamination in the primary beam of x rays, and should be accounted for in measurements of the total dose to the patient as well as in measurements of leakage radiation from the accelerator. Such measurements are complicated by the fact that the x-ray shielding material in the radiation head reduces the energy of most of the neutrons to a region below 0.5 MeV, where accurate dosimetry is difficult.

In addition, the collimators that act to limit the primary beam of x rays do not necessarily limit the neutrons, so the total neutron radiation dose to the patient may occur over an area considerably larger than that of the x-ray exposure. Also, the quality factor for the neutron component in the radiation can have a disproportionately large effect on the patient.

This conference will consider some of the major questions and uncertainties in this field, including the characteristics of the neutron radiation from these accelerators; the instrumentation and measurement techniques available for determining the neutron spectral fluence and dose both in the primary and leakage beams; the biological effects of neutrons and the appropriate quality factors to use in evaluating the hazards associated with a given accelerator; and the existing regulations, their interpretation and application, and the possible need for new regulations to deal with potential hazards.

The keynote address will be given by Dr. John S. Laughlin, Chairman of the Department of Medical Physics, Memorial Sloan-Kettering Cancer Center. Following the address there will be five sessions on Regulations, Patient Dose Distributions, Biological Interpretations, Physical Measurements, and Neutron Reduction Techniques, and a summary panel discussion. All papers will be invited, and the conference proceedings will be published by NBS.

The conference co-chairmen are John C. Villforth, Director of the Bureau of Radiological Health (Food and Drug Administration) and Dr. James E. Leiss, Director of the Center for Radiation Research (National Bureau of Standards). For further information, contact H. T. Heaton, Center for Radiation Research, C229 Radiation Physics Building, 301/921-2551.

CONFERENCE CALENDAR

April 2-4
TEMPERATURE COMPENSATION IN THE MEASUREMENT OF PETROLEUM PRODUCTS, NBS, Gaithersburg, MD; sponsored by NBS and NCWM; contact: Harold Wollin, A211 Metrology Building, 301/921-3677.

April 3-4
SYMPOSIUM ON BUILDING SECURITY, NBS, Gaithersburg, MD; sponsored by NBS and ASTM; contact: John Stroik, A355 Building Research Building, 301/921-2107.

****May 23-25**
MECHANICAL FAILURES PREVENTION GROUP, NBS, Gaithersburg, MD; sponsored by NBS and MFPG; contact: Harry Burnett, B264 Materials Building, 301/921-2813.

April 19-20
5TH ROOFING TECHNOLOGY CONFERENCE, NBS, Gaithersburg, MD; sponsored by NBS and NRCA; contact: Robert G. Mathey, B348 Building Research Building, 301/921-3407.

MAY 17
TRENDS AND APPLICATIONS SYMPOSIUM, NBS, Gaithersburg, MD; sponsored by NBS and IEEE; contact: Shirley Watkins, B212 Technology Building, 301/921-2601.

May 21-22
WORKSHOP ON THERMAL ANALYSIS, NBS, Gaithersburg, MD; sponsored by NBS and the University of Akron; contact: Oscar Menis, B326 Chemistry Building, 301/921-2175.

***June 4-6**
INTERNATIONAL CONFERENCE ON SYNCHROTRON RADIATION INSTRUMENTATION, NBS, Gaithersburg, MD; sponsored by NBS, Brookhaven National Laboratory, Stanford University, University of Wisconsin, Cornell University; contact: David Edwin, A251 Physics Building, 301/921-2031.

June 11-15
SYMPOSIUM ON ACCURACY IN POWDER DIFFRACTION, NBS, Gaithersburg, MD; sponsored by NBS, National Research Council of Canada, and the International Union of Crystallography; contact: Stanley Block, A219 Materials Building, 301/921-2837.

***June 18-20**
FOURTH INTERNATIONAL SYMPOSIUM ON ULTRASONIC TISSUE CHARACTERIZATION, NBS, Gaithersburg, MD; sponsored by NBS and NIH, contact: Melvin Linzer, A329 Materials Building, 301/921-2858.

* New Listings
**April 16-18 postponed to May 23-25.

PUBLICATIONS OF THE NATIONAL BUREAU OF STANDARDS

TEACHER AIDS

by Stan Lichtenstein

The following materials produced by agencies of the federal government are recommended by DIMENSIONS/NBS for their potential value to educators as supplements to the classroom or school library.

Lighthouse of the Skies: The Smithsonian Astrophysical Observatory

The stellar observatory chronicled in this 339-page hardback by science historian Bessie Zaban Jones was envisioned by John Quincy Adams during a Congressional discussion in 1838 of how to use James Smithson's $505 000 bequest. The "lighthouse of the skies" was long a-borning—it did not actually come into existence until 1890—but it readily took its place as a major facility of what Adams had called "the sublimest of all physical sciences . . . in which the field of future discovery is as unbounded as the universe itself." Absorbing chapters in the Jones book deal with "Experiments in Aerodynamics," "Eclipses and Annals," and "Experiments in Rocketry," among other things. Order at $5.00 (half-price) from:
Smithsonian Institute Press
P.O. Box 1641
Washington, D.C. 20013

Energy Insider

The U.S. Department of Energy publishes this newsletter biweekly for circulation as an employee publication and also upon request to researchers and others interested in the field of energy. Teachers can derive from it a government view of energy problems of today and tomorrow. Address:
Energy Insider
DOE-OPA, Mail Stop 7203
Washington, D.C. 20545

Lichtenstein is a public information specialist in the NBS Public Information Division.

NETWORK ACCESS MACHINE

The Design and Implementation of the NBS' Network Access Machine (NAM), Rosenthal, R., and Lucas, B. D., Nat. Bur. Stand. (U.S.), Spec. Publ. 500-35, 50 pages (June 1978) Stock No. 003-003-01949-6, $2.20.

This report discusses the Network Access Machine (NAM), a programmed minicomputer designed to assist interactive on-line terminal users of computer network services and resources.

The minicomputer allows the user to specify (or to have specified) network command sequences for execution on specified commands. Experience with the NAM and specific examples of NAM use, including a common command language for bibliographic retrieval, are presented.

Atomic and Molecular Studies

Sugar, J., Kaufman, V., and Spector, N., Spectrum and Energy Levels of Triply Ionized Ytterbium, J. Res. Nat. Bur. Stand. (U.S.), *83*, No. 3, 233-245 (May-June 1978).

Electronic Technology

Blackburn, D. L., Photovoltaic Technique for Measuring Resistivity Variations of High Resistivity Silicon Slices, J. Res. Nat. Bur. Stand. (U.S.), *83*. No. 3, 265-271 (May June 1978).

Koyama, R. Y., Detection of Deep Levels in High Power Semiconductor Materials and Devices, J. Res. Nat. Bur. Stand. (U.S.), *83*, No. 3, 273-281 (May-June 1978).

Fluids: Liquids, Gases and Plasmas

Rehm, R. G., and Baum, H. R., The Equations of Motion for Thermally Driven, Buoyant Flows, J. Res. Nat. Bur. Stand. (U.S.), *83*, No. 3, 297-308 (May-June 1978).

Metrology: Physical Measurements

Wood, S. D., Mangum, B. W., Filliben, J. J., and Tillett, S. B., An Investigation of the Stability of Thermistors, J. Res. Nat. Bur. Stand. (U.S.), *83*, No. 3, 247-263 (May-June 1978).

Properties of Materials: Thermodynamic and Transport

Mopsik, F. I., and Guttman, C. M., The Thermodynamics of the Glassy State I. The Heat Capacity of One-Dimensional Disordered Harmonic Systems from Moments, J. Res. Nat. Bur. Stand. (U.S.), *83*, No. 3, 283-295 (May-June 1978).

Standard Reference Data

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Chao, J., and Zwolinski, B. J., Ideal Gas Thermodynamic Properties of Methanoic and Ethanoic Acids, J. Phys. Chem. Ref. Data 7, No. 1, 363-378 (1978).

Chase, M. W., Jr., Curnutt, J. L., McDonald, R. A., and Syverud, A. M., JANAF Thermochemical Tables, 1978 Supplement, J. Phys. Chem. Ref. Data 7, No. 3, 793-940 (1978).

Goldberg, R. N., and Nuttall, R. L., Evaluated Activity and Osmotic Coefficients for Aqueos Solutions: The Alkaline Earth Metal Halides, J. Phys. Chem. Ref. Data 7, No. 1, 263-310 (1978).

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NEWS BRIEFS

A NEW AID FOR MEDICAL DOCTORS. A new Standard Reference Material from NBS will assist doctors in controlling the treatment of epileptic patients by allowing more accurate measurement of anti-epilepsy drugs in blood. This SRM is certified for concentrations of four anti-epilepsy drugs--diphenylhydantoin, ethosuximide, phenobarbital, and primidone--in a freeze dried, processed human serum base. Order SRM 900, Anti-epilepsy Drug Level Assay Standard, from the Office of Standard Reference Materials, Room B311 Chemistry Bldg., NBS, Wash., D.C. 20234. Cost is $104.00.

NBS AND GAS RESEARCH INSTITUTE REACH UNDERSTANDING. NBS and the Gas Research Institute will cooperate to improve the measurement capabilities of the gas industry. Joint efforts will include research on technologies important to gas utilization, supply, transmission, and distribution as well as the basic and applied research needed to establish, support, and advance these technologies.

SET IN CONCRETE. A new National Voluntary Laboratory Accreditation Program (NVLAP) has been started by the Department of Commerce for freshly mixed field concrete. Under the program, NBS will assist the Department in evaluating and accrediting testing laboratories--on a voluntary basis. The program is expected to bring a variety of economic benefits, including a reduction in quality control costs and construction delays now experienced because of unreliable testing.

WWV RESUMES 20 MHz SERVICE. Standard time and frequency station WWV, located near Ft. Collins, Colorado, and operated by NBS, has resumed broadcasting on a frequency of 20 MHz. Increased sunspot activity is improving propagation conditions at 20 MHz, thus giving that frequency the most reliable long distance reception (especially on the U.S. east coast) for many of the daylight hours. WWV service will continue unchanged on 2.5, 5, 10, and 15 MHz, and all other NBS radio broadcasts (WWVB, in Ft. Collins, and WWVH, in Hawaii) will also remain unchanged.

NATIONAL STANDARDS POLICY. An independent body called the National Standards Policy Advisory Committee (NSPAC) has issued a document delineating a national standards policy and a plan for its implementation. NSPAC, which describes itself as a group "established as a public service under the auspices of, but free from policy direction from, the American National Standards Institute," has sent copies of the document to Federal Government officials and standards organizations for review and consideration. For a free copy, write: National Standards Policy Report, 935 Washington Building, 1435 G Street N.W., Wash., D.C. 20005.

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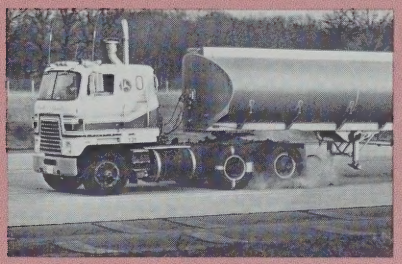

East Liberty, Ohio, November 1978. Officials from NBS and the National Highway Traffic Safety Administration test a truck braking system for susceptibility to electromagnetic interference. Read about the tests next month in DIMENSIONS/NBS.

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